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Saul Blumenthal and V.P. Bhapkar

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Final Scientific Report - Grant AFOSR 75-2841 - Awarded to Dept. of
Statistics, University of Kentucky.

Principal Investigator: Saul Blumenthal

Department of Mathematics

University of Illinois, Urbana-Champaign

AFOSR-TR- 89-0874

Co-Investigator: V. P. Bhapkar

- Department of Statistics

University of Kentucky

Since the grant involves two distinct projects, this report is
divided into two sections, number I dealing with the work of the principal
investigator, and number II dealing with the co-investigator's research.

I. Screening and Estimation Procedures for the Unknown Number of
Defective Items in a Life Test, and Estimation of the
Size of a Finite Population, Pt. I

Research Completed

A. Publications which have appeared.

All acknowledge grant support, and copies have been
filed with AFOSR.

1) Sequential Estimation of the Largest Normal Mean
When the Variance is Known, Annals of Statistics,
November, 1976, pp. 1077-1087.

2) A Comparison of the Bad as Old and Superimposed
Renewal Models, (joint with J. A. Greenwood and
L. H. Herbach). Management Science, November, 1976,
pp. 280-285.

3) Robustness of Stein's Two-Stage Procedure for
   Mixture of Normal Populations, (joint with
   Z. Govindarajulu), <u>Journal of the American Statistical
   Association</u>, March, 1977, pp. 192-196.

4) Estimating Population Size with Truncated Sampling,
   <u>Communications in Statistics</u>, A6(4), 1977, pp. 297-308.

5) Estimating the Complete Sample Size from an Incomplete
   Poisson Sample, (joint with Ram C. Dahiya and Alan J.
   Gross), <u>Journal of the American Statistical Association</u>,
   March 1978, pp. 182-187.

6) The Logistic Model and Estimation of Latent Structure,
   (joint with L. Sanathanan), <u>Journal of the American
   Statistical Association</u>, December 1978, pp. 794-799.

B. <u>Research Submitted for Publication</u>.

1) Estimation from Truncated Data with Inverse Binomial
   Sampling, (joint with L. Sanathanan), University of
   Kentucky Technical Report No. 109, April, 1977,
   submitted to <u>Communications in Statistics</u>.

2) Estimation with Truncated Inverse Binomial Samples,
   University of Kentucky Technical Report No. 110, April,
   1977, submitted to <u>Communications in Statistics</u>.

3) A Two Stage Procedure for Estimating the Size of a
   Truncated Exponential Sample, (joint with D. A. Watson),
   University of Kentucky Technical Report No. 117, January
   1978, submitted to <u>Australian Journal of Statistics</u>.

4) Maximum Modified Likelihood Estimation of Population
   Size (joint with D. A. Watson), submitted to
   Communications in Statistics.

Research in Progress at the Termination of the Grant

In a previous paper, the author gave a sequential screening procedure
for the case in which $F(t)$ was known completely, and results were stated in
terms of the exponential distribution. The procedure could be used if the
distribution contained an unknown scale parameter, provided that a bound
was given on the value of the parameter. However, it would be an inefficient
procedure in that case unless the parameter value was actually near the bound.
We have been investigating a "staged" sequential procedure which takes
observations for a fixed period of time T_0, then computes an estimate $\hat{\theta}$ of
the unknown scale parameter θ and thereafter uses the same sequential stopping
rule as in the earlier paper except that $\hat{\theta}$ is used in place of θ. The
goal is to guarantee with probability P^* that no more than $K(P^*, K$ given)
defectives remain after sampling terminates. Not only must we choose the
constants for the stopping rule as in the earlier work, but T_0 must also be
chosen. Some analytic results have been obtained, but the problem is not
readily amenable to analysis. Currently Monte Carlo studies are underway to
determine the probabilities of various numbers K remaining for different
choices of T_0, of the stopping constants, of θ, N, and different estimators
of θ. From these, we hope to be able to recommend approximately optimal
rules to assure the specified goals. We expect this to be a major advance
in making these screening procedures accessible for use in realistic situations.

Part II

Multivariate Nonparametric Methods for
Several Samples

Asymptotically distribution-free test criteria have been developed for "profile analysis" of several multivariate samples. The methodology has been discussed in detail in the technical report (1) cited in the Interim Scientific Report dated July 27, 1976. The article based on this report has been published in 1977 in the Journal of Multivariate Analysis (2), as reported in the second Interim Scientific Report dated August 22, 1977.

These asympotic methods have been tested on moderate size samples from some populations. The simulation results were reported in the technical report (3) cited in the 1976 Interim Scientific Report. An abridged version of these findings has been published in the Journal of Statistical Computation and Simulation (4).

The methodology has been extended to "scalar" profile analysis. The technical report (5) dealing with this work had been submitted to the Directorate of Mathematical and Information Sciences in September 1977. This manuscript has been also submitted for publication to a technical journal and is currently undergoing editorial review.

Finally, some tables were prepared for the exact critical points of the univariate version of one distribution-free test criterion for samll samples. This technical report (6) was cited in the 1977 Interim Scientific Report.

References

1. V.P. Bhapkar and K. W. Patterson, "On Some Nonparametric Tests for Profile Analysis of Several Multivariate Samples," University of Kentucky, Department of Statistics, Technical Report No. 100, March 1976.

2. V.P. Bhapkar and K.W. Patterson, "On Some Nonparametric Tests for Profile Analysis of Several Multivariate Samples," Journal of Multivaliate Analysis, Vol. 7, 265-277.

3. V.P. Bhapkar and K.W. Patterson, "A Monte Carlo Study of Some Multivariate Nonparametric Statistics for Profile Analysis of Several Samples," University of Kentucky, Department of Statistics Technical Report No. 101, March 1976

4. V.P. Bhapkar and K.W. Patterson, "A Monte Carlo Study of Some Multivariate Nonparametric Statistics for Profile Analysis of Several Samples," Journal of Statistical Computation and Simulation, Vo. 6, 223-237

5. V.P. Bhapkar, "Nonparametric Tests for Scalar Profile Analysis of Several Multivariate Samples," University of Kentucky, Department of Statistics Technical Report No. 114, September 1977.

6. V.P. Bhapkar and Jeffrey H. Schwartz, "Tables of significance points of the distribution-free V-statistic for several small samples," University of Kentucky, Department of Statistics, Technical Report No. 113, August 1977.